Thinking after Fukushima. Epistemic shift in social sciences

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Summary

The Fukushima catastrophe is a turning point in the conception, role and management of technology in industrial societies. As did Hiroshima (on another dimension) after 1945, the Fukushima's nuclear accident questions and transforms established conceptions and values concerning the relations between technology, politics, industry, society and the environment. It has become impossible to think after Fukushima as we did before. This catastrophe initiates a major epistemic and conceptual shift with long-term consequences. This paper focuses on a powerful conceptual complex associating the notions of risk, trust and knowledge society. This complex associates discourses, theories and policies. The objective is to criticize this conceptual complex in order to explore how to rethink *after Fukushima* the relations between technology, politics, industry and society.

Keywords: Japan, Fukushima, power, trust, risk, knowledge society, science and technology policies, nuclear energy, utilities companies, democratic control, political institutions

Introduction

A year after the catastrophe, the time has come to evaluate its historical meaning. Fukushima is not a disaster like others. This is the reason why it is becoming a turning point in world history: relations between technology, politics, industry, society and ecology are forever transformed. Its long-term impact and meaning are impossible to repress: wherever they live, people will never see and understand nuclear energy and nuclear industry as they did before, on the same pattern. Many studies, reports, debates have poured over the victims, the dead, the missing and the displaced, on all Japanese, on the contaminated land and sea, on

institutions, politicians, journalists, professors and experts, bureaucrats, managers and industrial companies (Japan focus 2012). At least, one thing is clear: the Fukushima catastrophe is an appeal for new knowledge. The goal of this paper is to understand how it changes the way we think. A paradox (a methodological challenge as well) has first to be solved: any discourse on Fukushima is an interpretation of the catastrophe. Accordingly it would not matter to start by the interpretation and then deduct from it an explanation of the event. But the catastrophe is a "scandal" of such magnitude and depth that it remains beyond its interpretations, indefinitely in excess. This excess is not a call for a metaphysical explanation but a call for new knowledge. To start by an interpretation or explanation would be part of the scandal because it would be an attempt to fall into an endless debate and close a real search. A description of the event has to come first because it drives all interpretations. Few events in world history have this rare property: in the recent past, the First World War, Nazism, the Holocaust, Hiroshima, the Gulag and now Fukushima. It cannot be denied that the analysis of the event presupposes its interpretation. But the event overpowers and overshadows established interpretations in the humanities and social sciences. This explains why such events open a paradigm shift.

1. What *really* happened at Fukushima?

A French psychoanalyst, Jacques Lacan (1966), introduced in the 1950s a difference between reality and what is real. What is commonly called "reality" covers the objects studied and explained by science, produced by technology, bought and used by consumers, by all of us. Reality is what makes propositions true, what common language seems to be talking about. Reality seems glued to our uses of language, to our minds, bodies, habits and customs. An event like Fukushima shows another side of reality, what is *real*. What is *real* is not common reality: it is what erupts or simply happens, what punctures and deconstructs daily routines and established knowledge. The real is what overflows our discourses and disciplines. Fukushima is an eruption and overflow. But the *real* is not something hidden, which suddenly appears or is revealed: it has always been there in the open but unseen, unnoticed because too obvious. Lacan takes an example from a short story by Edgar Poe of an open letter left on a mantelpiece, telling the *truth*, in view of everyone looking for the truth. The Fukushima catastrophe is showing what is *real* in Japan. What *really* happened at Fukushima was caused neither by the earthquake nor by the resulting tsunami: they just were the deadly trigger of a systemic catastrophe, all at once human, social, political, technological

and industrial. According to available knowledge, the catastrophe was caused by the *power structure*, which in Japan decided where to build this nuclear plant and its six reactors (Nishioka 2011). This power structure also selected the technology; it decided the standards for the plant's construction, its maintenance and back up systems, for the security of nearby population and for protecting also the environment, the land and the ocean (Crowell 2011, Koide 2011). Other nuclear plants have been built in highly seismic regions. Since March 2011, this power structure has been exhibited in great details by the media in a series of remarkable articles and studies. The dangers and mistakes were known, available on the public mantelpiece of the media, politicians, administrators, researchers and other experts. We all looked the other way.

This power structure associates the ministries in charge of technological research and energy supply, the METI (Ministry of economy, trade and industry) and the Ministry of education, research and sport (MEXT), the high administration of these ministries. It associates also the utilities companies. In the last fifteen years, sovereign wealth funds and their role in the global economy are under intense discussion. Nuclear technology is a typical *sovereign technology*. In the world and in each country, utilities companies should be called *sovereign industries* because they produce and distribute energy to the whole population and economy. They manage the territory and control the nation, including its foreign policy. Since March 2011, we have understood their power competes with the government's power: *Tokyo Electric Power* (TEPCO), owner and manager of the Fukushima-Daiishi nuclear power plant, has knowingly taken decisions against public safety, it is ready to defend and protect its interests against public interest and public will. TEPCO did not inform adequately the government of the situation at Fukushima, of all dangers for the nearby population and for the power plant employees. TEPCO even defied the elected government by not complying with all security and information requirements. This proves the limitations of our present democratic institutions.

A proof of the power of utilities companies like TEPCO is the attitude of Prime ministers concerning nuclear energy. *Tenkô* (turnaround, Takeuchi 2004) is a recurrent feature in Japanese history, it is often explained and justified by personal weakness, reduced to a change of mind, when it is in fact the result of extreme pressure on individuals, groups and even society[1]. It is the result of a power struggle. A typical case of *tenkô* was provided by the

[1] "Conversion may resemble *tenkô* on the outside, but its direction is the reverse. If *tenkô* is a movement toward the outside, conversion is a movement toward the inside. Conversion takes place by preserving the self, whereas *tenkô* occurs by abandoning the self", Takeuchi (1959) 2004, p 75.

Democratic Party of Japan (DPJ), which since the mid 2000s carried the hope of the Japanese population. After having proclaimed during the electoral campaign that « green growth » was a key point of the « regime change », after the historical victory of the DPJ on 30 August 2009, the *Federation of electric power companies of Japan* issued on August 31 a strong declaration asking the new government to respect former commitments toward nuclear energy[2]. DPJ's first Prime minister, Yukio Hatoyama, had the goal to strengthen his ministers' control on their administration in order to implement his government policies. But this did not extend to controlling the relations between ministries and utilities companies. Succeeding Yukio Hatoyama, the president of the DPJ, Naoto Kan, became Prime minister from June 2010 until end of August 2011, less then one year after his party's victory. On December 2nd 2010, the Deputy director general for environmental affairs at METI declared at the *Climate change conference* in Copenhagen that Japan's energy policy did not develop anymore within the objectives of the Kyoto Protocol. This declaration was confirmed by the Prime minister's office the next day, on December 3rd, 2010. Andrew DeWit & Tetsunari Iida (2011) explain that the DPJ's *tenkô* is « better understood when put against the backdrop of the party's collusion with incumbent interests (…) They include monopoly electrical utilities (…) carbon intensive industries such as cement, steel and other industries ». After the Fukushima-Daiichi catastrophe[3], Naoto Kan made another *tenkô* on July 14th 2011 and declared himself for a « nuclear-free society ». The scandal behind this series of *tenkô* is the suffering of the victims and the betrayal of the Japanese people, of their trust in democratic institutions. The financing of political parties by utilities companies is a part of this scandal; it is one cause, among others, of the disaster, more important even than the earthquake and the tsunami. Of course Naoto Kan's last *tenkô* had no meaning because he was leaving office at the end of August 2011.

Today, a year after the catastrophe, the nuclear industry has not renounced its objectives: nuclear energy is still promoted as the best and only solution for Japan. This industry now justifies its role and explains its mission as managing the transition between a fossil fuel energy system and the next, *green*, one. This sounds reasonably true, very similar to the German and Swiss cases. But in the case of Japan, as a result of the complete loss of trust between the population, utilities industries and the state, this is not anymore the main issue: the contamination is here and the transition might last for ever. The real danger is the

[2] See http://www.fepc.or.jp/english/news/message/1199866_1653.html.

[3] The director of the Climate change division of the Ministry of foreign affairs in Prime minister Kan's government declared on April 5th 2011 as "groundless a report in the *Nikkei* financial daily that Tokyo has decided to seek an exemption from its Kyoto obligations" (Reuters).

power of sovereign industries controlling a sovereign technology built in the administration as a power structure.

This danger might seem exaggerated. But a recent example proves how high and wide the risk is. It proves also the cynicism of these industries and the extent of their control over the nation. It involves the legal system. The newspaper *Asahi Shimbun*[4] has reported a legal procedure opposing TEPCO and the owner of a golf course, who is suing the utility company because his golf course situated at forty-five kilometers from Fukushima is contaminated and had to be closed to the public. TEPCO lawyers reject this claim on the ground that the radioactive substances emanating from the Fukushima-Daiishi plant do not belong to the company once they are in the atmosphere and pushed by the wind. The company argues that these substances are to be considered as "*res nullius*", things, which belong to no one, like "mist in the sky or fish in high seas". Even worse is the following argument: "even if usual property law would apply to such substances, they are by now incorporated to the ground. Therefore TEPCO cannot be taken as being anymore the owner of these particles". A Court of justice rejected the claim of the plaintive on October 31st. The only benefit of this decision is that everybody in Japan knows from now on which side the justice system stands.

Finally, this power structure associates the media, which are largely financed and influenced by utilities companies. As explained in many studies and articles, by its scale, its level of investment and its intrinsic danger, nuclear power is both a technology and an industry to which a power structure identifies with and is ready to invest in (Shiokura 2011). This techno-structure concentrates the financial means, the knowledge and the power to build nuclear plants, manage these plants, distribute energy and manage all these individuals and groups, industries and other economic activities, which consume energy. Nuclear energy is the perfect match for a strong and unified power structure. What *really* happened at Fukushima is the public exhibition of the power structure controlling and managing Japanese society and economy. The power structure is naked and tries to find new clothes[5]. This was always known, in Japan and elsewhere[6]. What is revealed as false and wrong are the information, explanations, justifications and reports produced and distributed by utilities companies, by ministries and the media all these years, as well as the willingness of large

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[4] French translation : "A Fukushima, il faut savoir écouter les irradiés", Paris, *Courrier international*, n° 1105, 5-12 January 2012, p 32. I translate from the French.

[5] The debate on reconstruction is beyond the scope of this paper.

[6] Like in Japan, the nuclear industry and other utilities industries in France are fully embedded in the state apparatus, in its internal connections with industry and research. The two leading political parties do not dare to challenge their power.

parts of the population to believe what they were told. People decided to believe them because they needed the jobs or simply because they were not asked if these plants could be built in their neighborhoods. What is at stake after Fukushima, is our present conception, institutions and practice of democracy.

2. The metaphysics of risk

What *really* happened at Fukushima-Daiishi is not an internal Japanese affair: a conceptual complex replicated in all advanced industrial nations was torn apart like the buildings covering the nuclear reactors. It organizes and manages the interactions between research, industry, government and society. It is composed of three sets of discourses, a discourse on risk, one on trust, the third is the ideology, vision and program of a "knowledge society". The three are closely aggregated. These notions encompass a series of issues, theories and policies. Fukushima has opened the possibility to analyze each of them, how they are connected in a powerful conception of society, technology, politics and the economy. They are so deeply embedded in our societies that each of them has been since the 1980s the subject of an influential book, which opened until today strong debates and research in politics and the media and social sciences. The Fukushima catastrophe has been explained, debated and also managed according to this conceptual complex. The goal is to analyze the complex by criticizing each type of discourse in order to explore what can be learned from the Fukushima.

To mention Lacan's distinction between reality and "what is *real*" has the goal to avoid and criticize metaphysical interpretations of the Fukushima catastrophe referring to an overpowering nature, uncontrollable by mankind, unpredictable by human technology, whatever precautions (seawalls, dykes, back up and security systems, evacuation policies and exercises) human endeavors can imagine and build. This metaphysical interpretation is the very one TEPCO is developing since the catastrophe. TEPCO did what all it could before and after, a tsunami of this magnitude could not been reasonably foreseen, nature cannot be controlled by mankind, the wish to control nature is vain and even dangerous because nature is always more powerful than any human anticipation and precaution, etc. It's destiny but still the duty of humans is to edify their own world, the conditions to develop and prosper. To be sure, TEPCO managers and communication specialists share this popular metaphysics with administrators from METI, the MEXT and many other experts from different fields, including the media. This metaphysics inspire bureaucrats, politicians, journalists as well as a large

share of engineers and researchers the world over. The world over, nuclear industries and other sovereign industries are concerned by the short and long-term consequences of the Fukushima catastrophe. Apparently they worry about the contaminated land and people because of the costs involved, but in fact they are worried about what *really* happened. This metaphysics, its related debates and theories, are proven false.

This popular metaphysics has a long history. It was best expressed by Martin Heidegger's conception of technology (Heidegger 1977). In 1950, after Nazism, the Second World War, the Holocaust and Hiroshima, the German philosopher was denouncing the folly of modern humanity of "enframing"[7] *(Gestell)* nature, to dominate and control nature. Nature is objectified by modern science and then reduced by technology to resources to exploit, accumulate and distribute. For Heidegger, the source of this folly is Western metaphysics, which he contrasts to ancient Greece's conception of humanity living in harmony with nature. Heidegger's philosophy had and still has a great influence: the Fukushima catastrophe seems to prove him right and ground his philosophy. In his essay on technology, Heidegger gives as example a dam on the river Rhine: it *enframes* not only the water flow but the myths and imagination of a whole culture and society[8]. Fukushima-Daiichi nuclear plant is a perfect substitute for the dam on the Rhine. But this metaphysics has two main drawbacks: utilities companies share the same idea: Nature is overwhelming and cannot be *enframed* without high risk; it dissimulates the real question, which does not concern the power of nature but the power of utilities companies on society and the economy. Any Heideggerian discourse on the Fukushima catastrophe is ineffective.

An updated and refined expression of this metaphysics is found in Ulrich Beck's influential book, *Risikogesellschaft* (1986) (*The risk society*). He developed an alternative perspective on the problems raised by Heidegger and his commentators. The strength of the book is to propose a broad conception of risk, from ecological and industrial risk to social and individual risk, including the evolution of the family, sexuality and new forms of subjectivity. The notion of risk becomes a picture and a vision of the various evolutions reshaping industrial societies since the 1980s. In this perspective, risk cannot be reduced to the precautionary principle and to risk analysis. Deeper than an ideology, it is a metaphysics looming over all industrial societies. Beck's goal is to conceptualize from a sociological point

[7] For definition of *enframing*, its connection to technology and modern science, see Heidegger 1977 p 20-23.
[8] "What the river is now, namely, a water power supplier, derives from out of the essence of the power station", (p 16-17).

of view this new « modern social order[9] » (part 3). The source of these transformations is the ecological transition, which erupted in the 1970s with the first massive energy crisis. Today, especially since 2006, this energy crisis has proved its full depth and massive impact: it has altered the conditions of economic and social development of all industrial societies. This evolution justified and still justifies nuclear energy.

The energy and ecological challenge has replaced the metaphysics of nature and its nostalgia. This crisis has driven industrial societies beyond the historical opposition between external risks (natural disasters) and internal risks proper to techno-industrial societies, whether "old", "mature" or "newly industrialized". Ulrich Beck explained in the 1980s that this opposition between external and internal risks had vanished. It had become an obstacle to a proper understanding of the present social, economical and ecological condition of industrial societies. Natural risks could be assessed, some of them prevented or at least reduced. Today these risks are internalized within modern societies. They cannot be interpreted as natural or external accidents: social and economic systems are responsible for most natural disasters, from flooding due to deforestation and anarchic urbanization to global warming due to carbon emissions by industries and unsustainable energy consumption, due to transport and urban, suburban and even rural life styles. This is true all over the planet, in rich and poor countries. Social and economic systems are themselves the source of various natural catastrophes, from the Chernobyl paradigmatic case to extinction of natural species due to extensive use of pesticides in intensive agriculture, overexploitation of lands and potential food shortages due to the production of bio-fuel.

The overcoming of the opposition between nature and society, between two distinct and conflicting orders[10], is breaching a deep anthropological order, at least in Western societies. The notion of risk expresses this transgression. What was called "nature" until recently has become the ecology of social and economic systems, which are destabilizing the biophysical conditions of life on the planet. Ulrich Beck interprets this diagnosis as proof of a new modernity: all social and economic problems are ecological problems, the reverse being also true. They have become one single and multi-faceted process, which has extended the level of risk and disequilibrium beyond institutional control and political management. The highest risk is that disequilibrium could initiate an irreversible and uncontrollable evolution. The problem is not that various human activities have the potential of ecological and social

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[9] It is also a response and refutation of post-modern cultural studies (Beck, Giddens, Lash, 1994) strongly influenced by Heidegger's disciples.

[10] In the European context, this taboo opposition dates from ancient Greece.

destruction similar or even higher than natural catastrophes. This new risk level is not the result of a decision taken by one nation, but the uncontrolled consequence of competition between nations. The risk intensifies because such a situation is beyond the precautionary principle[11]. In summary, the idea that we live in a risk society is a diagnosis on the present evolution of industrial societies and a conception of a new modernization where the taboo opposition between nature and society has vanished. The level of risk reaches a metaphysical scale: life on the planet and the human condition are in danger.

This diagnosis requires a critical investigation in order to dedramatize these issues and reduce them to the scale of human research and political debate. Today, mature, advanced and new industrial societies are forced to learn how to adjust their conception of economic development and their level of social consumption to their retro-effects on their environment in order to reach a long-term sustainable development. In this sense, risk has become the defining feature of the social and economic conditions of contemporary mankind. It seems a metaphysical experience because of constant awareness and anxiety. But risk expresses another side of modernity: no transcendental order is imposed on humans. They cannot hope to refer to universal values in order to solve such problems. Humans have to behave according to an immanent order common to all natural beings and non-natural beings, to humans and non-humans. This immanent order is not metaphysical, something of a higher order, already there and in need of being unveiled: it is a common construction and responsibility, researched, debated and negotiated. An immanent order is a fragile but effective object of joint investigation and debate in order to reach sustainable decisions. Risk should not express fear but that humans need knowledge and action in order to solve problems. Paradoxically, the real hope one should have is that risk reaches quickly such a high level that joint research and policies become the only resort. In their influential book drawing on several experiments in Japan and Europe, Callon, Lascoume & Barthe (2001) explain that the time has come to imagine and organize democratic institutions adapted to a "risk society". A "technological democracy" has the goal to manage risk according to collective rational decisions within a democratic process. Risk is at the core of all advanced industrial societies, in their industries, laboratories, life styles and ecology. The most dangerous response to this situation is to transform risk into a vision of society and ecology beyond knowledge, politics and policies.

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11 The precautionary principle is a risk management technology. Its goal is not to reduce risk but only to assess the limits within which a project is justified and considered tolerable by a population or a government, which is supposed to represent and protect this population. For a distinction between risk and uncertainty, see Callon, Lascoume & Barthe (2001), p 37-55.

On the contrary, the response to problems articulating science and technology, society, politics and industry calls for the formation of an advanced democracy.

3. The paradox of trust

Facing and managing risk, as metaphysics or object of research and debate, raise the question of trust, trust in science and technology, in political institutions, in the economic system. The question of trust has reemerged in industrial societies since the 1980s. Trust has a long history, dating from *Fides*, the Roman goddess of all contracts. Trust is also a typical liberal notion, dating back to the role of consent and reciprocity in early liberal thinkers, source of modern democratic theory. For Locke (1690), consent and trust are the basic human bond[12]. Trust is at once the experience, decision and will, which grounds and makes life in common possible. Revisiting trust today is therefore a diagnosis on contemporary societies.

Like risk in Ulrich Beck's book, the question of "trust" is related to a historical moment and to an influential book written by Francis Fukuyama (1995). Sign of times, in the introduction, Fukuyama declares it to be a "book on economics", not in political theory. In a few years, trust would become a worldwide field of research and debate. After having predicted the "end of history" when the Soviet Union had collapsed and China turned to a market economy, F. Fukuyama was now trying to explain the emergence and consequences of the neo-liberal movement. Since the 1980s, neo-liberalism was revolutionizing, one after the other, all industrial societies, including former communist nations. As we still remember, it was supposed to open an age of worldwide economic growth and political freedom. F. Fukuyama's intention was to explain that neo-liberalism could not be reduced to a set of economic techniques to be learned and applied around the globe. It was based on culture and values, on those "social virtues" best exemplified in American history: a strong work ethics (p 45) and a "spontaneous sociability" (p 46) had created "an art of association" between hard work and knowledge in successful entrepreneurial projects. Trust was supposed to be the key explanation of the spirit of American capitalism. This spirit was cultural, deeper than history, customs and institutions. But this culture of capitalism was not an ethnic feature proper to a given people or civilization: it could spread to other nations, be adapted and adopted.

Fukuyama's argument relies on a distinction between low-trust and high-trust societies. This distinction modifies the usual opposition between traditional and modern

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(capitalist) societies, between community and society. Strong family values creates high trust within each family, clans or people. But they also intensify low-trust between families, clans and people. According to Fukuyama, this explains why nations based on family, clans and ethnic groups are usually poor, underdeveloped and under the authoritarian power of one group on all others: it hinders overall economic and social progress because any change would alter the balance of power between families or ethnic groups. In these conditions, common economic and politic sphere cannot emerge. By comparison, a high-trust society, like the US, England, Germany and even Japan, is a type of society where clannish ties and ethnic bonds have evolved toward growing individualization. Families and ethnic communities have not disappeared but individuals are in charge of their own destiny, of the wellbeing of their families. To achieve these modern goals, individuals need to cooperate with each other, to build association and common enterprise in a public space emancipated from ethnic, religious or clannish control. Histories are many but the spirit common to all liberal societies is based on "sustaining sociability" between large groups of people. This is the ideal version of the "melting pot", the model of a political community of individuals.

For Fukuyama, America is obviously a nation based on high-trust and strong collective sociability. But his diagnosis expresses anxiety: high-trust is starting to erode. Fukuyama does not explain if neo-liberalism is the sickness or the cure because, at this stage of his political and philosophical evolution, the sickness has its source in social policies, which had been eroding US competitiveness and made individuals less able and willing to solve by themselves their economic and social problem. Neo-liberal policies were still considered the cure: it was supposed to make people freer and stronger and the US more competitive.

As a vision of society, neo-liberalism is a rearrangement of the relations and hierarchies between society, government, the economy as well as religion. This vision and ideology had a major influence on all industrial nations. But this increased differentiation has introduced a void and a gap at the core of society. It made societies more *flexible*. But the various functions constituting a social system do not fit anymore into a coherent whole. Economic interests, models and values have taken precedence. People in their daily life, facing personal and private problems, have developed the feeling that they are left outside the dynamics of society. They feel the need to reorganize and make sense of their lives at another level. Neo-liberalism is also a collective and individual experience based on distrust and anxiety. The situation is quite different from Fukuyama's diagnosis in the 1990s. The new

degree of autonomy granted to the economy is also a new degree of autonomy granted to society, to individuals and groups in this society. This type of autonomy emerging since the 1980s is quite different from modern political freedom as well as from the moral (sexual) emancipation of the 1960s.

This evolution had three main consequences. The first consequence was the rise of the problem of ethics and law. Typically, according to John Rawls's work, what people have in common in contemporary society is reduced to a conception of justice and fairness, to a subjectively acceptable degree of equality or inequality. The second consequence was mainly seen in the US, even it can also be observed in other regions and countries. This emptying of society and the resulting personal anxieties generated a wide return to religion. Religion became a last refuge for many of those who were losing their jobs and social identity. As a result, faith became more intimate, radical and irrational. Religion itself was transformed: it is atomized in many competing religious sects, churches and spiritual movements, often associated to various right wing political groups. Established churches cannot control this evolution.

The third evolution is the reinvention of the modern ideal of "civil society", of the capacity of individuals and groups to find between themselves, at their own level and in their immediate communities, the capacity and the will to develop solidarities, common projects and common forms of resistance, mainly against government and businesses. Neo-liberalism is not all economic: it is also characterized everywhere by strong social movements for the environment, against pollution and nuclear energy, for food safety, against GMOs, or against new fields of medical research (like stem cells), against tyranny and corruption. There are strong interactions, and confusion, between these expressions of "civil society", religion, ethics and social movements. This return of "civil society" is highly significant even if the themes associating people mainly concern their immediate lives and interests. What is significant is strong commitment and active resistance[13]. This surge and reinvention of civil society in each neo-liberal evolution might be the most enduring consequence of neo-liberalism.

In this context, the question of "trust" has become a major issue. Since the 1980s, trust has become a major requirement in business and politics, superseding traditional respect for social elites and even for competence. But trust remains a personal experience according to which individuals judge politicians, professors, experts, companies and their managers. A

[13] For instance " les insoumis" in France, "Occupy Wall Street" in the US, in Spain, Greece, Italy, Russia, etc.

neo-liberal society might strengthen for a given moment the economy but the social basis of this economy is unstable and its political legitimacy basically weak, constantly questioned. It is a paradox: this surge in economic activities experienced since the 1980s rests on a fragile social basis, because society is reduced to an experience of trust, on ethical values and is judged according to benefits to individuals and groups. In the case of Japan, the long-term crisis, political failures and the Fukushima catastrophe have destroyed trust in institutions. But it has also reinforced the need and hope for "civil society", for interactions between individuals and groups outside and against the present power structure. This situation is opening a collective search for democratic progress. If this search is betrayed, Japan will simply decline and indefinitely lose ground.

Neo-liberalism has emptied society and reduced the social experience to anxiety and frustration, distrust and even treason. The 2007 systemic crisis and now the Fukushima catastrophe reinforce and justify this individual and collective experience. This instills a volatile situation, which can lead to irrational behaviors and demands as well as violence. Democracy is basically a political technology to associate individuals and groups in order to manage conflicts and reach decisions accepted by all parties involved. Neo-liberalism contradicts this basic conception of democracy but at the same time this very conception of democracy is the only solution opened to manage and solve the problems created by this neo-liberal social regime. One thing is clear: neo-liberalism has reached its level of contradiction and has become counter-productive. Both discourses on risk and trust lead therefore to the same problem: reinventing democracy.

4. Knowledge society versus knowledge economy

These two discourses of risk and trust are closely associated to science and technology. The third component of the conceptual complex articulating today the relations between science, technology, society and the economy is both an ideology and a program, the idea of "knowledge society". Since the 1980s, research and innovation policies are supposed to drive industrial societies beyond their present economic and social problems. Today they are supposed to bring solutions to ecological challenges and to provide innovations capable of restoring competitiveness, of creating new industries. These industries are supposed to create jobs paying for new taxes, which will finance social programs as well as these science and technology policies in an endless spiral of innovation and progress. This ideal vision and its related policies have different names: the formation of a "high-added value economy" or

"knowledge economy", more generally "knowledge society" (Rieu, 2005). These theories, discourses and policies have their source in mid 1980s Japan. Taichi Sakaya (1985) published in 1985 *The knowledge-value revolution or the history of the future* in which he explained that "the zenith of the industrial society" has been reached: the "post-war petroleum culture" ended in the 1970s with the energy crisis. A new technological revolution has started: it generates "a shift in demand that will favor the consumption of knowledge value rather than natural resources" (introduction). The added value extracted from research and innovation has always in the past and would continue in the future to supersede the value of natural resources. Today this idea is considered so obvious that it is not even questioned anymore.

In the late 1980s, Christopher Freeman (1987, 1988) and other British economists and sociologists (Martin Fransman, 1990) were studying how Japan had succeeded in a few years to transform the latest technological wave, computer science, into a set of new industries and services. A new type of industrial policy, of a different scale, had been created and a new model for organizing and managing industrial societies was born. The concept of "national system of innovation" was invented at that time in order to describe how universities, government agencies and business firms could be associated in a coherent institutional arrangement in order to coordinate research, investment, innovation and production with the goal to stimulate economic growth and social progress. This institutional arrangement is a decisive, *Schumpeterian*, innovation in the evolution of advanced industrial societies[14]. Since the 1990s, this powerful theory led in each industrial nation to the conception and implementation of large-scale research policies, competing and collaborating with each other at the same time (Rieu, 2008).

The summary of this argument opens two main comments. First, this evolution has in a few years completely transformed the conception, organization and role of science and technology in the evolution of industrial societies and in the competition between societies. This evolution is a deep and probably irreversible mutation in the evolution of science and technology, in their relations to politics, society, culture and the economy. Ulrich Beck in the third part (chapter 7) of *Risk society* (1986) presents some epistemological aspects of this mutation, but in the mid 1980s, the historical scale of this mutation could not be foreseen. Because science and technology are considered today the basis of long-term social and economic development, because these policies are more and more inclusive and involve all aspects of life in society, research and innovation policies have learned since the mid 2000s to

[14] It is also a response and alternative to neo-liberalism. See Rieu (2011).

prevent and take into consideration any strong public opposition and civil resistance. Such research policies cannot be implemented against public opinion and civil society. Since 2006 and the 3rd Basic plan, Japanese science and technology policies explicitly refer to public opinion and social needs. For the last fifteen years, public debates are organized in a rigorous and even exemplary fashion[15] (ScienceWise 2011). Arimoto Tateo (2006)[16] has explained how these procedures are embedded in the conception of the 4th Basic plan for science and technology. Since March 2011, a tension and even a divorce are obviously running deep between sovereign industries and society, but also between these industries and those institutions, which since the 1990s are orienting Japan in a different direction. Indeed these programs heavily finance and promote research on new energy sources, energy and transport.

To associate the population in the design of these large-scale policies policies remains a difficult challenge. But the reason for it is clear: first, the global cost of potential failure is too high. Public trust in these policies is considered essential. It can certainly be misled but, as proven by the case of GMOs, the risk of open public opposition is counter-productive. Various studies show that people trust scientists and researchers more than the institutions for which their work. Secondly, the intellectual competence and the level of financial investment required for implementing such large-scale research and innovation policies are so high that the resulting trajectory is or is nearly irreversible. A society, which designs such large-scale policies, is therefore taking an extreme risk, the risk of a long-term dependency path. The only solution to manage such a risk is to share it amongst the largest possible amount of people. The only solution is to manage such a policy as an experiment in advanced democracy. We reach again the conjuncture described by Callon, Lascoume & Barthe (2001 2011). These small-scale experiments are a forerunner of major political reforms adapted to the growing environmental constraint, to comprehensive research and innovation policies and to the resulting transformations of social and economic systems. Such reforms and innovations are obviously part of the solution to overcome the Fukushima catastrophe and also the present systemic crisis.

After Fukushima

The Fukushima catastrophe is opening a deep epistemic shift in human and social sciences. The conceptual complex regulating the evolution of industrial societies through

[15] Callon, Lascoume, Barthe (2001), prologue.

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science and technology policies is under deconstruction. The presuppositions and limitations of its three components, a theory of risk, a conception of trust and the idea of "knowledge society" are now exposed to public scrutiny. The apparent rationality, efficiency and legitimacy of this complex failed to anticipate, prevent and respond to this disaster. Its real function was to dissimulate the power structure behind. To analyze these networks of mutual interests and supports is an exercise in democracy. The deconstruction of this conceptual complex is opening a different conceptual framework based on analysis of power networks, on alternative interactions between science, technology and society, and on a theory of democracy adapted to a society driven by research and innovation policies. The challenge is now to prove the validity of this new conceptual framework.

The most urgent task concerns nuclear energy and industry. According to this new framework, we should not even debate whether nuclear energy is safe, clean or not. It is not the real problem anymore. As society, individuals are always in need of trust and trust is an unreachable goal. Our societies will never know the truth about nuclear safety. The issue is not to trust nuclear industries or not, but to learn how to collectively manage uncertainty. One thing is known for sure: society will never be able to control a sovereign technology and sovereign industries, which require an aggregation of power and resources beyond political oversight. Such a power structure cannot be controlled by a democratic society. Therefore nuclear technology and industry defy and deny democracy. This is the reason why nuclear plants should be closed and the nuclear industry stalled as long as advanced industrial societies have not imagined and implemented the political reforms able to produce knowledge, organize debate and implement reliable democratic control with respect to this technology. For the moment, a democratic society should not develop sovereign industries it cannot control. Concerning nuclear energy, before real democratic innovations are implemented, alternative energies will probably develop and mature. Societies will then be able to compare which energy sources are best adapted to a democratic society. In the present situation, nuclear energy is a technology of the past, a legacy of the 20th century.

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